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SID 62-99-29

MONTHLY WEIGHT AND BALANCE REPORT
FOR THE APOLLO SPACECRAFT

CONTRACT NAS 9-150

51

(U)

PARAGRAPH 8.10 EXHIBIT I

1 JULY 1964



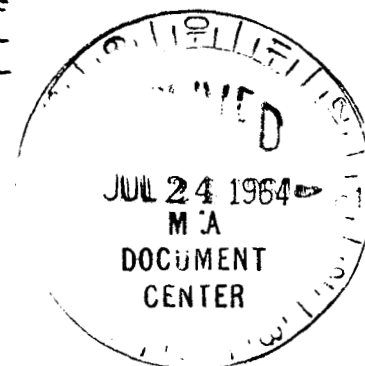
Prepared By

WEIGHT CONTROL

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INTRODUCTION

The July report is the first report to reflect the current Block II LOR spacecraft as defined in the proposed NASA Block II configuration. The current weight status summarizes the changes from the previous Block I vehicle, and the estimated changes for the Block II LOR Mission Spacecraft. This format allows weight status reporting consistent with airframe release and continuous updating of the estimated LOR changes. The potential change section reflects possible change to the Block I spacecraft. The Detail Weight Statement reflects the estimated weight breakdown of the Block II spacecraft. The August Detail Weight Statement will include the Block I detail weights in addition to the Block II column.

The Launch Escape System has been revised to include the full boost protective cover weight.

The Adapter has been changed to reflect the S-IV B in lieu of the S-IV in the Block I vehicles to be compatible with the Saturn I-B launch vehicle now required for earth orbit mission.

The current report reflects a Block II LOR spacecraft increase of 265 pounds at injection and 230 pounds at the injected spacecraft condition less Service Module propellant. The current injected weight of 90,335 pounds is based on Service Module propellant loading for a specific impulse of 313.0 seconds, and ΔV budget of the MSC Letter PE 5-64-78, dated approximately 11 February 1964, subject Contract NAS 9-150, Velocity Budget, Target Weight and Mission Plans. This is based on a lunar excursion module of 29,500 pounds, excluding crew.

The Earth Orbit Mission Weight Summary has been revised to reflect the Saturn IB booster with a payload capability in orbit of 32,310 pounds. The payload capability has been reduced by 125 pounds due to the effective weight penalty of the Launch Escape System weight over 7,275 pounds. The Service Module is loaded with 8,330 pounds of propellant.

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APOLLO LOR MISSION

WEIGHT, CENTER OF GRAVITY AND INERTIA SUMMARY

ITEM	WEIGHT POUNDS	CENTER OF GRAVITY*			MOMENTS OF INERTIA (SLUG-FT. 2)		
		X	Y	Z	ROLL (X)	PITCH (Y)	YAW (Z)
COMMAND MODULE	10050	1043.0	0.0	6.9	4758	4239	3793
SERVICE MODULE - Less Propellant	10130	908.3	1.2	-0.6	6595	9890	9863
TOTAL - Less Propellant	20180	975.4	0.6	3.1	11416	33948	33415
PROPELLANT - S/M**	36980	911.9	2.9	-1.2	19224	17359	23977
TOTAL - With Propellant	57160	934.3	2.1	0.3	30708	62716	68763
LUNAR EXCURSION MODULE	29500	589.5	0.0	0.0	19409	21485	21219
ADAPTER - LEM - S-IV B	3675	667.0	0.0	0.0	9192	12731	12731
TOTAL - Injected	90335	810.8	1.3	0.2	59329	613382	619182
LAUNCH ESCAPE SYSTEM	7935	1297.7	0.0	-0.1	547	19516	19532
TOTAL - SPACECRAFT LAUNCH	98270	850.1	1.2	0.2	59879	1006094	1011913

NOTES: *Centers of gravity are in the NASA reference system except that the longitudinal axis has an origin 1000 inches below the tengency point of the Command Module substructure mold line

**The propellant weight of 36980 pounds is determined from an estimated time line analysis. The propellant weight is based on a specific impulse of 313.0.

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APOLLO EARTH ORBIT MISSION
WEIGHT, CENTER OF GRAVITY AND INERTIA SUMMARY

ITEM	WEIGHT POUNDS	CENTER OF GRAVITY*			MOMENTS OF INERTIA (SLUG-FT ²)		
		X	Y	Z	ROLL (X)	PITCH (Y)	YAW (Z)
COMMAND MODULE	10050	1043.0	0.0	6.9	4758	4239	3793
SERVICE MODULE - Less Propellant	10130	908.3	1.2	-0.6	6595	9890	9863
TOTAL - Less Propellant	20180	975.4	0.6	3.1	11416	33948	33415
PROPELLANT - S/M**	8330	880.5	27.3	-11.5	2766	1824	2233
TOTAL - With Propellant	28510	947.7	8.4	-1.1	15362	47502	48014
ADAPTER - S-IV B	3675	667.0	0.0	0.0	9192	12731	12731
TOTAL - Injected	32185	915.6	7.4	-1.0	24604	115581	116141
LAUNCH ESCAPE SYSTEM	7935	1297.7	0.0	-0.1	547	19516	19532
TOTAL - Spacecraft Launch	40120	991.2	6.0	-0.8	25228	335686	336338

NOTES: *Centers of gravity are in the NASA reference system except that the longitudinal has an origin 1000 inches below the tangency point of the Command Module substructure mold line.

**The earth orbital weights are based on a complete Service Module and includes 8330 pounds of propellant. This propellant loading is based on a payload in orbit of 32310 pounds. The payload capability has been reduced by 125 pounds to include the effective weight penalty due to the Launch Escape System increase over 7275 pounds.

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APOLLO LAUNCH ABORT CONFIGURATION

WEIGHT, CENTER OF GRAVITY AND INERTIA SUMMARY

ITEM	WEIGHT POUNDS	CENTER OF GRAVITY*			MOMENTS OF INERTIA (SLUG-FT ²)		
		X	Y	Z	ROLL (X)	PITCH (Y)	YAW (Z)
COMMAND MODULE	10050	1043.0	0.0	6.9	4758	4239	3793
LAUNCH ESCAPE SYSTEM	7935	1297.7	0.0	-0.1	547	19516	19532
TOTAL - Launch Abort	17985	1155.4	6.0	3.8	5352	85888	85412
LESS - MAIN AND PITCH MOTOR PROPELLANTS	-3190	1296.2	0.0	0.0	69	1288	1288
TOTAL - LES Burnout	14795	1125.0	0.0	4.6	5271	67989	67525

NOTES: *Centers of gravity are in the NASA reference system except that the longitudinal axis has an origin 1000 inches below the tangency point of the Command Module substructure mold line.

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COMMAND MODULE
WEIGHT, CENTER OF GRAVITY AND INERTIA SUMMARY
LUNAR ORBIT RENDEZVOUS MISSION

VEHICLE MODE	WEIGHT POUNDS	CENTER OF GRAVITY			MASS INERTIA DATA (SLUG-FT. 2)					
		X	Y	Z	Ixx	Iyy	Izz	Ixy	Ixz	Iyz
COMMAND MODULE, LAUNCH	10050	1043.0	0.0	6.9	4758	4239	3793	7	-260	-22
ADJUSTMENTS (NET)	-77									
Boost & Mission Coolants										
Food & Water Consumption										
Mission Waste Pickup										
Fuel Cell Water Pickup										
Docking Provisions										
PRIOR TO ENTRY	9973	1041.7	0.1	7.4	4804	4143	3655	14	-269	-26
Less: Propellant	-135	1022.6	-5.1	56.6						
Ablator Burnoff	-365	1016.2	0.0	15.7						
Entry Coolant	-6	1022.6	14.0	64.0						
Forward Heat Shield	-247	1088.0	0.0	3.4						
Drogue Chutes	-50	1090.0	0.0	-22.0						
PRIOR TO MAIN CHUTE DEPLOYMENT	9170	1041.5	0.2	6.5	4386	3620	3208	10	-199	-17
Less: Main Chutes (3)	-396	1091.0	-0.7	7.7						
Propellant	-135	1022.6	-5.1	56.6						
LANDING	8639	1039.5	0.3	5.7	4240	3248	2865	11	-179	-9

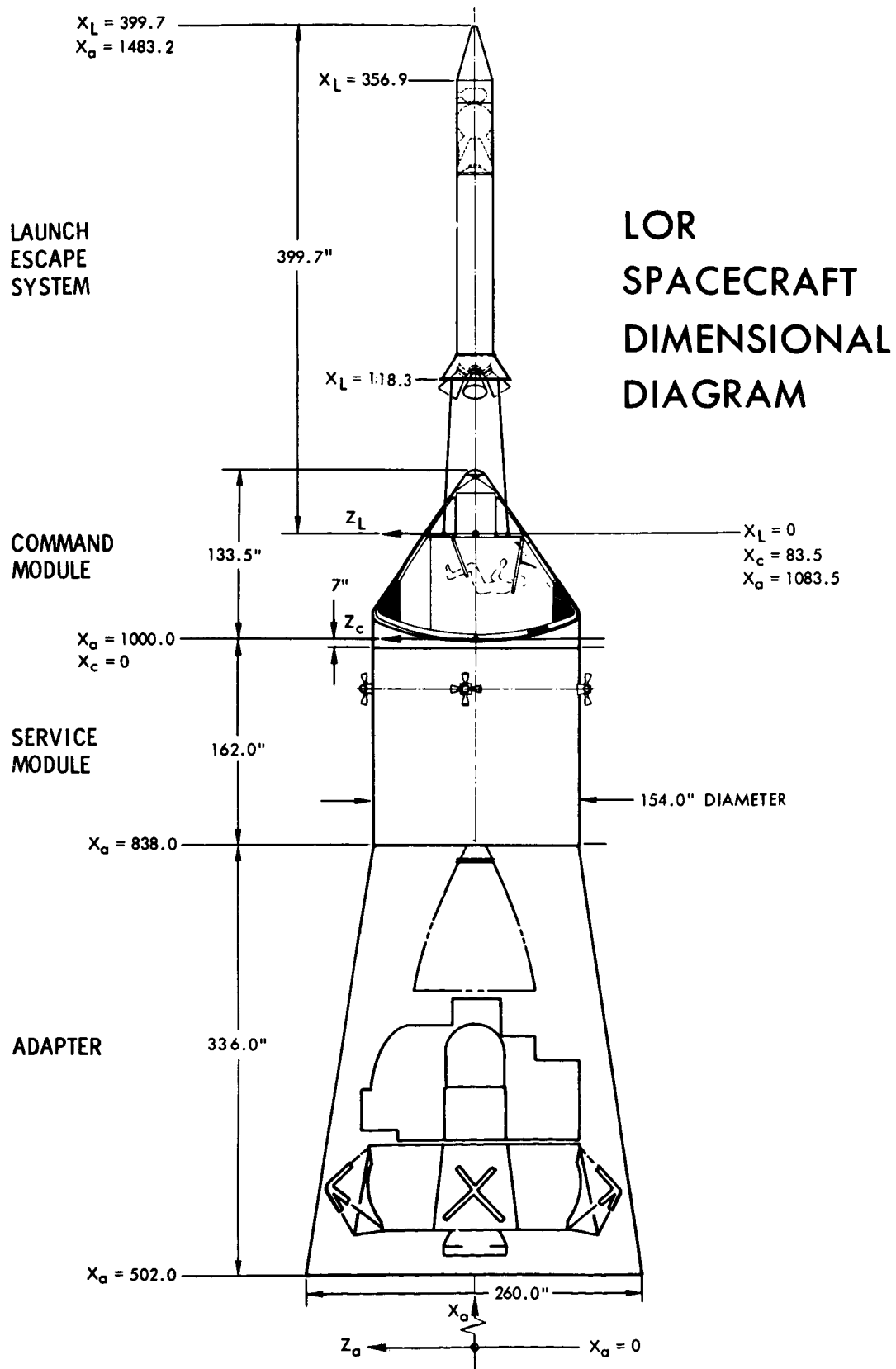
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COMMAND MODULE

WEIGHT, CENTER OF GRAVITY AND INERTIA SUMMARY

LOW ALTITUDE ABORT CONDITION

VEHICLE MODE	WEIGHT POUNDS	CENTER OF GRAVITY			MASS INERTIA DATA (SLUG-FT. ²)					
		X	Y	Z	Ixx	Iyy	Izz	Ixy	Ixz	Iyz
COMMAND MODULE, LAUNCH	10050	1043.0	0.0	6.9	4758	4239	3793	7	-260	-22
Less: Oxidant	-180	1022.6	15.6	62.4						
Forward Heat Shield	-247	1088.0	0.0	3.4						
Docking Provisions	-150	1110.0	0.0	0.0						
Drogue Chute	-50	1090.0	0.0	-22.0						
PRIOR TO MAIN CHUTE DEPLOYMENT	9423	1040.9	-0.3	6.2	4558	3771	3440	18	-181	-55
Less: Main Chutes (3)	-396	1091.0	-0.7	7.7						
Fuel	-90	1022.6	-46.5	44.9						
LANDING	8937	1038.9	0.2	5.7	4440	3443	3078	5	-176	-21



NOTE: This page is to be revised consistent with the Block II Configuration

~~CONFIDENTIAL~~SPACECRAFTWEIGHT STATUS SUMMARY(LESS LEM)

ITEM	PREVIOUS AFRM 011 STATUS 6-1-64	CHANGES TO CURRENT BLOCK I	CURRENT BLOCK I WEIGHT 7-1-64	ESTIMATED CHANGES TO BLOCK II	CURRENT BLOCK II WEIGHT 7-1-64	BASIS FOR CURRENT BLOCK I STATUS		
						%EST	%CAL	%ACT
COMMAND MODULE	10340	+140	10480	-430	10050	29	71	
SERVICE MODULE - B/O	9925	-5	9920	+210	10130	15	74	11
LES	7405	+635	8040	-105	7935	24	70	6
ADAPTER	885	+2765	3650	+25	3675	100		
TOTAL LESS PROPELLANT	28555	+3535	32090	-300	31790	31	64	5
PROPELLANT	-	-	-	-	36980	-		
GROSS WEIGHT	-	-	-	-	68770	-		

INJECTED SPACECRAFTWEIGHT STATUS

ITEM	PREVIOUS BLOCK II STATUS 6-1-64	CHANGE TO CURRENT	CURRENT BLOCK II STATUS 7-1-64
COMMAND MODULE	10030	+20	10050
SERVICE MODULE	10120	+10	10130
ADAPTER	3475	+200	3675
LEM	29500		29500
TOTAL S/C Injected Less Propellant	53125	+230	53355
PROPELLANT	36945	+35	36980
TOTAL INJECTED WEIGHT	90070	+265	90355

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COMMAND MODULE WEIGHT STATUS

ITEM	PREVIOUS AFRM OLL STATUS 6-1-64	CHANGES TO CURRENT BLOCK I	CURRENT BLOCK I WEIGHT 7-1-64	ESTIMATED CHANGES TO BLOCK II	CURRENT BLOCK II WEIGHT 7-1-64	BASIS FOR CURRENT BLOCK I STATUS		
						%EST (29)	%CAL (71)	%ACT (-)
WEIGHT EMPTY	(9030)	(+140)	(9170)	(-938)	(8232)			
Structure	(4819)	(+127)	(4946)	(-478)	(4468)			
Structure - Less Ablator	3466	+3	3469	-138	3331	6	94	
Ablation Material	1353	+124	1477	-340	1137	20	80	
Stabilization & Control	234		234	-27	207	17	83	
Guidance & Navigation	379	-4	375	-5	370	44	56	
Crew Systems	471		471	-80	391	19	81	
Environmental Control	318		318	+21	339	33	59	8
Earth Landing System	635	+14	649	+45	694	78	22	
Instrumentation	561		561	-312	249	63	37	
Electrical Power	601		601	-22	579	83	17	
Reaction Control	332	+9	341	-5	336	62	38	
Communications	340	-6	334	-59	275	35	65	
Controls & Displays	340		340	-16	324	22	78	
USEFUL LOAD	(1310)		(1310)	(+128)	(1438)	(30)	(70)	
Scientific Equipment	-	-	-	+80	80	-		
Crew Systems	899		899	+85	984	43	57	
Reaction Control	270		270		270		100	
Environmental Control	141		141	-37	104		100	
CONTINGENCY & BALLAST	-		-	(+380)	(380)	-		
GROSS WEIGHT	10340	+140	10480	-430	10050	29	71	

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COMMAND MODULECURRENT BLOCK I WEIGHT EMPTY CHANGESSTRUCTURE

(+127.0)

Increase ablation material consistent with current Avco report reflecting weights based on current heating rates.

+124.0

Increase secondary structure based on calculation of released drawings reflecting addition of studs and brackets required for electrical and data storage supports in the lower equipment bay.

+ 3.0

GUIDANCE AND NAVIGATION

(-4.0)

Decrease Guidance and Navigation System based on current MIT report reflecting the following changes:

Decrease in the coupling display unit based on actual in lieu of estimated weights. -0.9

Increase in the optical base per calculated in lieu of estimated weights. +0.3

Decrease in the coolant hoses based on revised estimate. -0.3

Deletion of horizon photometer based on current requirements. -3.2

Increase in film cartridges based on actual in lieu of estimated weights. +0.1

EARTH LANDING SYSTEM

(+14.0)

Increase drogue chute pack assembly based on Northrop report reflecting calculated in lieu of estimated weights.

+4.7

Decrease drogue chute mortar based on Northrop report reflecting redesigns utilizing titanium, aluminum and fiberglass.

-12.3

Increase main cluster chute pack based on Northrop report reflecting calculated in lieu of estimated weights.

+20.0

Increase pilot chute pack assembly based on Northrop report reflecting calculated in lieu of estimated weights.

+1.4

Increase sequence control based on Northrop report reflecting actual in lieu of calculated weights.

+0.2

COMMAND MODULECURRENT BLOCK I WEIGHT EMPTY CHANGES

<u>REACTION CONTROL SYSTEM</u>	(+9.0)
Decrease propellant tank based on Bell report reflecting actual weights of fuel and oxidizer tank shell assemblies.	-0.8
Increase pressure tanks based on specification weight increase.	+1.0
Increase engines based on Rocketdyne report reflecting actual in lieu of calculated weights of the engine components.	+6.8
Increase engines due to revised vibration levels reflected in engine specification.	+2.0
<u>COMMUNICATIONS</u>	(-6.0)
Increase C-band transponder based on Collins report reflecting vibration fixes and the addition of a filter for EMI control.	+0.4
Increase VHF/AM receiver beacon based on Collins report reflecting actual in lieu of calculated weights.	+0.6
Delete VHF-UHF diplexer due to the addition of a UHF updata link channel to the VHF multiplexer.	-1.5
Delete the 2-KMC high gain antenna transmission lines as there is no requirement for this item on the Block I vehicles.	-5.5
<hr/>	
TOTAL COMMAND MODULE CURRENT BLOCK I WEIGHT EMPTY CHANGES	+140.0

SERVICE MODULE WEIGHT STATUS

ITEM	PREVIOUS AFRM OIL STATUS 6-1-64	CHANGES TO CURRENT BLOCK I	CURRENT BLOCK I WEIGHT 7-1-64	ESTIMATED CHANGES TO BLOCK II	CURRENT BLOCK II WEIGHT 7-1-64	BASIS FOR CURRENT BLOCK I STATUS		
						%EST	%CAL	%ACT
WEIGHT EMPTY	(7695)	(-5)	(7690)	(-125)	(7565)	(19)	(67)	(14)
Structure	2305		2305	+5	2310	9	76	15
Environmental Control	168		168	+37	205	12	87	1
Instrumentation	130		130	+11	141	26	74	
Electrical Power	1436		1436	-4	1432	15	34	51
Propulsion System	(3079)		(3073)	(-343)	(2730)			
Engine Installation	727	-7	720	-10	710	50	50	
Propulsion System	2352	+1	2353	-333	2020	13	87	
Reaction Control	576	+1	577	-50	527	61	39	
Communications & Rendezvous Radar	1		1	+219	220	100		
USEFUL LOAD	(2230)		(2230)	(+185)	(2415)		(100)	
Reaction Control	838		838		838		100	
Electrical Power	503		503		503		100	
Environmental Contr.	208		208		208		100	
Main Propulsion	681		681	+185	866		100	
CONTINGENCY				(+150)	(150)			
BURNOUT WEIGHT	9925	-5	9920	+210	10130	15	74	11
Main Propellant	-		-		36980			
GROSS WEIGHT	9925	-5	9920		47110			

SERVICE MODULECURRENT BLOCK I WEIGHT EMPTY CHANGES

<u>MAIN PROPULSION</u>	(-6.0)
Decrease engine due to incorporating Aerojet report reflecting the following changes:	-14.0
Decrease in injector due to reduced flange thicknesses.	-5.4
Decrease in main valves due to incorporation of hollow balls and aluminum cages.	-8.8
Decrease in thrust struts due to redesign and material change for weight reduction.	-3.7
Increase in actuators based on current supplier quotes.	+4.4
Decrease in hardware based on actual weights.	-0.5
Increase engines due to NASA direction (TWX W5500MA) to provide baffled injectors in lieu of unbaffled injectors and to orient the development of the SPS engine to provide a dynamically stable injector capable of meeting the MSC instability criterion.	+8.0
<u>REACTION CONTROL SYSTEM</u>	(+1.0)
Decrease propellant tanks based on Bell report reflecting actual weights of the fuel and oxidizer tank shell assemblies.	-2.0
Increase quantity gauging per Giannini report reflecting longer fiber optics on the sensors.	+1.0
Increase pressure system helium tank based on revised specification weights.	+2.0
 TOTAL SERVICE MODULE CURRENT BLOCK I WEIGHT EMPTY CHANGES	 -5.0

~~CONFIDENTIAL~~LAUNCH ESCAPE SYSTEMWEIGHT STATUS

ITEM	PREVIOUS AFRM OII STATUS 6-1-64	CHANGES TO CURRENT BLOCK I	CURRENT BLOCK I WEIGHT 7-1-64	ESTIMATED CHANGES TO BLOCK II	CURRENT BLOCK II WEIGHT 7-1-64	BASIS FOR CURRENT BLOCK I STATUS		
						%EST	%CAL	%ACT
Structure	1239		1239		1239	45	55	
Electrical System	85		85		85	5	95	
Propulsion System								
Main Thrust	4774		4774		4774		100	
Jettison	434		434		434			100
Jettison Motor								
Skirt	92		92		92			100
Pitch Control	49		49		49		100	
Separation Provisions	13		13		13		100	
C/M Boost Prot. Cover		+520	520		520	100		
LES - NO BALLAST	6686	+520	7206		7206	15	78	7
BALLAST	719	+115	834	-105	729	100		
TOTAL L.E.S.	7405	+635	8040	-105	7935	24	70	6

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LAUNCH ESCAPE SYSTEMCURRENT BLOCK I CHANGES

BALLAST (+115)

Increase ballast consistent with Command Module and LES balance requirements. +115

BOOST COVER (+520)

Incorporate a boost protective cover which will completely enclose the conical portion of the Command Module and will be attached to and jettisoned with the LES. +520

TOTAL LAUNCH ESCAPE SYSTEM CURRENT BLOCK I CHANGES +635

~~CONFIDENTIAL~~ADAPTERWEIGHT STATUS

ITEM	PREVIOUS AFRM O11 STATUS 6-1-64	CHANGES TO CURRENT BLOCK I	CURRENT BLOCK I WEIGHT 7-1-64	ESTIMATED CHANGES TO BLOCK II	CURRENT BLOCK II WEIGHT 7-1-64	BASIS FOR CURRENT BLOCK I STATUS		
						%EST	%CAL	%ACT
Structure	709	+2511	3220	-75	3145			
Electrical	20	+50	70		70			
Propellant Dispersal System				+100	100			
Separation System	156	+204	360		360			
TOTAL ADAPTER	885	+2765	3650	+25	3675	100		

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ADAPTERCURRENT BLOCK I CHANGES

Increase the Adapter weight due to utilizing the S-IV B Adapter in lieu of the S-IV Adapter as the current Block I missions will be flown on an S-IB Booster in lieu of an S-I.

+2765

COMMAND MODULECURRENT ESTIMATED WEIGHT EMPTY CHANGES TO BLOCK II

STRUCTURE	(-478.0)
Decrease the ablator due to incorporating a boost protection cover and thermal control paint.	-265.0
Decrease ablator due to changing ablator thickness to criteria of 600°F at chute deployment.	-50.0
Decrease ablator due to incorporating the flat top heat shield design.	-25.0
Reduce heat shield window glass thickness from 0.70 inch to 0.55 inch based on a more detailed thermal and structural analysis.	-11.0
Add LEM docking provisions for the LOR mission.	+150.0
Add lower equipment bay supports required for food compartments which were previously provided by Crew Systems.	+8.0
Decrease secondary structure heat shield equipment area due to removing supports which are installed in the early Airframe for support of flight qualification equipment.	-4.0
Decrease the heat shield substructure due to enlarging the umbilical from 1000 to 1300 wires which requires a larger cutout in the heat shield.	-3.0
Remove window from side hatch and replace with panel for Lunar Landing Mission.	- 25.0
Decrease forward heat shield due to incorporating the flat top heat shield design.	-48.0
Decrease heat shield center section frames due to utilizing titanium pork chops frames and stringers.	-41.0
Decrease inner structure due to incorporating a single point parachute attachment.	-80.0
Reduce factor of safety from 1.5 to 1.4 in areas requiring redesign.	-6.0

COMMAND MODULECURRENT ESTIMATED WEIGHT EMPTY CHANGES TO BLOCK IISTRUCTURE (CONT'D)

Decrease rendezvous window wells due to utilizing honeycomb in lieu of castings.	-11.0
Decrease forward heat shield due to removal of access door to pitch motor.	-5.0
Decrease lower equipment bay structure and coldplates due to incorporating full electronic repackaging and ring mounted lower equipment bay design.	-64.0
Decrease vent due to replacing copper with beryllium.	-8.0
Decrease aft compartment supports due to equipment relocation for center of gravity improvement.	-7.0
Relocate forward pitch engines.	+7.0
Add provisions to allow extra vehicular activity thru the side hatch.	+10.0

STABILIZATION & CONTROL

(-27.0)

Increase wiring based on adding S-IV B control interface and body bending filters.	+5.0
Increase equipment due to miscellaneous humidity and EMI proofing.	+30.0
Decrease equipment and wiring due to repackaging for the ring mounted lower equipment bay concept and incorporating switchable redundant parts.	-30.0
Delete requirement for in-flight maintenance.	-22.0
Increase wiring consistent with the 1300 wire umbilical requirement.	+14.0
Decrease electrical wiring and connectors based on reduced wire gauges and utilizing small connectors.	-24.0

COMMAND MODULECURRENT ESTIMATED WEIGHT EMPTY CHANGES TO BLOCK II

<u>GUIDANCE AND NAVIGATION</u>	(-5.0)
Decrease electrical wiring and connector based on reduced wire gauges and utilizing small connectors.	-17.0
Decrease guidance and navigation system due to incorporating the Block II G & N system for the lunar spacecraft.	-10.0
Increase wiring consistent with the 1300 wire umbilical requirement.	+10.0
Add wiring provisions for the rendezvous radar equipment.	+17.0
Decrease wiring due to deleting requirement for the computer keyboard from the controls and displays.	-5.0
<u>CREW SYSTEMS</u>	(-80.0)
Increase egress accessories due to adding aids for extra vehicular activities.	+10.0
Reduce trilox pads from three layers to two layers and delete worktable assembly per current requirements.	-4.0
Delete food storage box supports as this requirement has been integrated with secondary structure design.	-16.0
Decrease crew couch due to redesigning for a unitized configuration.	-70.0
<u>ENVIRONMENTAL CONTROL</u>	(+21.0)
Provide the CO ₂ absorber elements with a bypass in order to attain minimum oxygen flow of 10 CFM/Man in 3.5 psia (suited) condition.	+10.0
Add free condensate control to minimize free water build up that could degrade electronic equipment.	+10.0
Add LEM water transfer system.	+5.0

COMMAND MODULECURRENT ESTIMATED WEIGHT EMPTY CHANGES TO BLOCK IIENVIRONMENTAL CONTROL (CONT'D)

Utilize a combined tank with separate compartments for waste water and potable water.	-4.0
Increase provisions for S/M temperature control system.	+2.0
Decrease electrical wiring and connectors based on reduced gauges and utilizing small connectors.	-2.0

EARTH LANDING SYSTEM

(+45.0)

Incorporate Block II configuration utilizing a single point parachute attachment and repackaging of chutes.	-9.0
Reduce thrusters due to changing from four tension springs to two.	-10.0
Add a bag system to provide an apex up single point flotation attitude only.	+15.0
Redesign main parachutes for higher descending weight.	+50.0
Decrease electrical wiring and connectors based on reduced gauges and utilizing small connectors.	-1.0

INSTRUMENTATION

(-312.0)

Delete instrumentation required for flight qualification.	-305.0
Add Nuclear Radiation Detection provisions required for the lunar vehicle.	+7
Add wiring to provide connection between the caution and warning panel and the units previously tested with the in-flight test system.	+5.0
Add provisions to provide for S-IV B EDS interface.	+20.0
Add checkout provisions for the LEM in the stowed and docked position.	+31.0

COMMAND MODULECURRENT ESTIMATED WEIGHT EMPTY CHANGES TO BLOCK IIINSTRUMENTATION (CONT'D)

Decrease PCM equipment due to repackaging for the ring mounted lower equipment bay concept.	-22.0
Increase wiring consistent with the 1300 wire umbilical requirement.	+49.0
Decrease electrical wiring and connectors based on reduced wire gauges and utilizing smaller connectors.	-90.7

ELECTRICAL POWER

(-22.0)

Increase electrical wiring consistent with the 1300 wire umbilical requirement.	+50.0
Decrease wiring and connectors based on reduced wire gauges and utilizing small connectors.	-66.0
Repackage post-landing batteries.	-12.0
Utilize fuel cell power in lieu of pyro battery for S/M separation.	-8.0
Incorporate complete EPS humidity fix.	+10.0
Add a DC to DC regulator.	+4.0

REACTION CONTROL

(-5.0)

Increase electrical wiring consistent with the 1300 wire umbilical requirement.	+5.0
Decrease wiring and connectors based on reduced wire gauges and utilizing small connectors.	-10.0

COMMUNICATIONS

(-59.0)

Increase signal conditioner due to replacing dummy modules with signal conditioning module for redundancy.	+7.0
Eliminate C-Band and utilize S-Band for low altitude tracking.	-35.0

COMMAND MODULECURRENT ESTIMATED WEIGHT EMPTY CHANGES TO BLOCK IICOMMUNICATIONS (CONT'D)

Decrease equipment and wiring due to repackaging for the ring mounted lower equipment bay concept.	-54.0
Decrease equipment due to deleting requirement for in-flight maintenance.	-20.0
Increase equipment due to miscellaneous humidity and EMI proofing.	+20.0
Add a redundant S-Band power amplifier.	+6.0
Replace the scimitar antenna with the "S" band antenna.	+22.0
Transfer the VHF antenna to the Service Module.	-15.0
Add provisions for switchable redundant S-Band Transponder and Premodulation Processor.	+5.0
Increase VHF-HF Recovery provisions due to adding VHF decent and post landing HF Antennas.	+1.0
Increase electrical wiring consistent with the 1300 wire umbilical requirement.	+9.0
Decrease wiring and connectors based on reduced wire gauges and utilizing small connectors.	-15.0
Increase electrical provisions due to adding wiring required for the high gain antenna.	+10.0

CONTROLS AND DISPLAYS

(-16.0)

Chem-etch mounting panels for the LOR vehicles that could not be accomplished due to schedule on Block I.	-5.3
Decrease lower equipment bay G & N controls and displays due to incorporating the Block II G & N system for the lunar spacecraft.	-2.0
Add rendezvous radar panel required for LOR mission.	+7.0
Add Nuclear Radiation Display.	+3.5

COMMAND MODULECURRENT ESTIMATED WEIGHT EMPTY CHANGES TO BLOCK IICONTROLS AND DISPLAYS (CONT'D)

Add high gain antenna control required for deep space communication.	+2.5
Modify control and display for the lunar vehicle.	+29.0
Add GOSS updating to CTE.	+2.0
Delete main display computer keyboard and utilize LEB computer control only.	-26.0
Decrease main display panel due to eliminating subpanels and display be increasing time sharing of display.	-6.0
Increase electrical wiring consistent with the 1300 wire umbilical requirement.	+21.8
Decrease wiring and connectors based on reduced wire gauges and utilizing small connectors.	-42.5

TOTAL COMMAND MODULE CURRENT ESTIMATED WEIGHT EMPTY CHANGES TO BLOCK II-938.0
(To be brought forward)

COMMAND MODULECURRENT ESTIMATED USEFUL LOAD CHANGES TO BLOCK II

<u>SCIENTIFIC EQUIPMENT</u>	(+80.0)
Add scientific equipment based on current LOR mission requirements.	+80.0
<u>CREW SYSTEM</u>	(+85.0)
Add two portable life support systems based on the current requirements of the LOR vehicle and LEM.	+120.0
Decrease hygiene and medical storage boxes based on redesign of containers that cannot be accomplished on early Block I vehicles.	-6.0
Reduce food due to offloading for a 10 day in lieu of 14 day mission. (Useful Load)	-23.0
Decrease flight kits based on redesign deleting sextants.	-6.0
<u>ENVIRONMENTAL CONTROL</u>	(-37.0)
Reduce lithium hydroxide due to off loading for a 10 day in lieu of 14 day mission. (Useful Load)	-37.0
 TOTAL COMMAND MODULE ESTIMATED USEFUL LOAD CHANGES TO BLOCK II (To be brought forward.)	 +128.0

COMMAND MODULECURRENT ESTIMATED CHANGES TO BLOCK IICONTINGENCY (+160)

Due to lack of realistic design data, a contingency allowance is included in accordance with the Block II briefing to NASA.

+160

BALLAST (+220)

Preliminary information indicate ballast will be required to attain an L/D of .43. Studies are in progress to incorporate aerodynamic fixes to alleviate this problem.

+220

TOTAL This Page +380

TOTAL COMMAND MODULE ESTIMATED WEIGHT EMPTY CHANGES TO BLOCK II -938

TOTAL COMMAND MODULE ESTIMATED USEFUL LOAD CHANGES TO BLOCK II +128

TOTAL COMMAND MODULE ESTIMATED CHANGES TO BLOCK II -430

SERVICE MODULECURRENT ESTIMATED WEIGHT EMPTY CHANGES TO BLOCK II

<u>STRUCTURE</u>	(+5.0)
Add structural beef-up required to support the rendezvous radar equipment.	+35.0
Add structural provisions for supporting the high gain antenna.	+30.0
Increase structural provisions for the C/M to S/M umbilical fairing due to enlarging the capacity to 1300 wires.	+10.0
Increase engine mount and backup structure due to stiffness requirements.	+50.0
Add micrometeoroid protection in outboard sectors of the four propellant tanks to afford the greatest reliability. The shielding will be of an internal type mounted directly to the outboard panels.	+100.0
Incorporate a passive SPS and RCS thermal control.(Insulation, propellant, etc.)	+100.0
Decrease structure due to reducing factor of safety from 1.5 to 1.4 on all structures requiring redesign.	-25.0
Shorten Service Module structure from 155 inches to 143 inches to be compatible with the shorter propellant tanks sized for 41,000 pounds usable.	-57.0
Decrease outer shell panel based on redesign to a semi-arched structure with a lesser end moment requirement and a change in the helium pressurization access door from structural to nonstructural.	-95.0
Decrease radial beams due to reduction in web gauges, stiffener cap area, and inner and outer cap areas.	-30.0
Decrease forward bulkhead due to redesigning to a spider truss structure in lieu of honeycomb panels.	-73.0
Decrease aft bulkhead due to a reduction of face sheet thickness, density of honeycomb core, and the outer ring.	-15.0

SERVICE MODULECURRENT ESTIMATED WEIGHT EMPTY CHANGES TO BLOCK IISTRUCTURE (CONT'D)

Decrease insulation on aft bulkhead due to reduction in Q-felt density. -15.0

Decrease outer shell panel due to an increase in radiator size required by the freon loop temperature control system. -10.0

ENVIRONMENTAL CONTROL (+37.0)

Delete propellant temperature control system as the Block II vehicle employs a passive system. -80.0

Incorporate a freon cooling system in lieu of a water glycol circuit and add a secondary redundant cooling loop due to the reliability requirements of the lunar mission. +117.0

INSTRUMENTATION (+11.0)

Add radiation detection sensors to the Service Module. +3.0

Add provisions for LEM monitoring in a stowed position. +22.0

Increase wiring consistent with the 1300 wire umbilical. +40.0

Decrease wiring and connectors based on reduced wire gauges and utilizing small connectors. -54.0

ELECTRICAL POWER (-4.0)

Increase wiring consistent with the 1300 wire umbilical. +38.0

Decrease wiring and connectors based on reduced wire gauges and utilizing small connectors. -42.0

PROPULSION (-343.0)

Decrease propellant and oxidizer tank gauges based on refined tank pressure regulation by utilizing precision valves which allow design for pressure relief at 225 psi rather than 240 psi. -50.0

SERVICE MODULECURRENT ESTIMATED WEIGHT EMPTY CHANGES TO BLOCK IIPROPULSION (CONT'D)

Decrease propellant and oxidizer tank gauges based on reducing helium quantity and allowing for P_c decay.	-80.0
Incorporate SPS electrically operated ball valves.	-10.0
Decrease propellant and oxidizer tanks due to shortening the tanks for a 41,000 pound usable propellant.	-199.0
Increase wiring consistent with the 1300 wire umbilical.	+13.0
Decrease wiring and connectors based on reduced wire gauges and utilizing small connectors.	-17.0

REACTION CONTROL SYSTEM

(-50.0)

Redesign RCS engine support housing to accommodate increased dynamic loads.	+12.0
Delete RCS heat shield due to incorporating titanium face sheets to the outer panel.	-50.0
Increase wiring consistent with the 1300 wire umbilical.	+13.0
Decrease wiring and connectors based on reduced wire gauges and utilizing small connectors.	-17.0
Reduce attachments for structural closeouts on RCS panels.	-8.0

COMMUNICATIONS & RENDEZVOUS RADAR

(+219.0)

Add high gain antenna system required for deep space communications.	+64.0
Add rendezvous radar equipment consistent with the LOR requirements.	+125.0
Transfer VHF communication antenna from the Command Module.	+30.0

TOTAL SERVICE MODULE ESTIMATED WEIGHT EMPTY CHANGES TO BLOCK II
(To be brought forward)

-125.0

SERVICE MODULECURRENT ESTIMATED USEFUL LOAD CHANGE TO BLOCK IIMAIN PROPULSION

(+185.0)

Decrease helium quantity allowing for P_c decay.

-22.0

Increase SPS residuals based on new mixture ratio tolerances
and trapped residuals.

+207.0

TOTAL SERVICE MODULE ESTIMATED USEFUL LOAD CHANGES TO BLOCK II
(To be brought forward)

+185.0

SERVICE MODULECURRENT ESTIMATED CHANGES TO BLOCK IICONTINGENCY

(+150)

Due to lack of realistic design data, a contingency allowance is included in accordance with the Block II briefing to NASA.

+150

TOTAL This page

+150

TOTAL SERVICE MODULE ESTIMATED WEIGHT EMPTY CHANGES TO BLOCK II

-125

TOTAL SERVICE MODULE ESTIMATED USEFUL LOAD CHANGES TO BLOCK II

+185

TOTAL SERVICE MODULE ESTIMATED CHANGES TO BLOCK II

+210

LAUNCH ESCAPE SYSTEMCURRENT ESTIMATED WEIGHT CHANGES TO BLOCK IIBALLAST

(-105)

Decrease ballast consistent with current Command Module LES
balance requirements.

-105

TOTAL LAUNCH ESCAPE SYSTEM ESTIMATED WEIGHT CHANGES TO BLOCK II

-105

ADAPTERCURRENT ESTIMATED WEIGHT CHANGES TO BLOCK II

Decrease SIVB Adapter utilized on the Block I vehicles due to removing the structure trusses required to stiffen the Adapter when the LEM is not installed.	-75
Add a Service Module and LEM dispersal system utilizing a dependent type system.	+100
<hr/>	
TOTAL ADAPTER CURRENT ESTIMATED WEIGHT CHANGES TO BLOCK II	+25

WEIGHT HISTORY COMMENTS

LAUNCH ESCAPE SYSTEM

The design goal established for the LES is 6,300 pounds, excluding ballast. This weight was based on the September 1962 status weight of 6,600 pounds, including the necessary ballast to provide currently determined aerodynamic stability to prevent tumbling.

The original design goal of 5,900 pounds, as reported in the June status, SID 62-99-5, was based on an attitude controlled configuration. The current configuration weight includes a pitch motor and ballast not included in the original target weight.

COMMAND MODULE

The design goal established for the Command Module is 8,500 pounds. An estimated weight breakdown for the design goal is provided for comparative purposes.

The original design goal weight of 8,340 pounds, as reported in the June status, SID 62-99-5, did not include the proposed increases nor the Category I reductions presented in the July briefing and incorporated in the July Status Report.

SERVICE MODULE

The design goal established for the Service Module less usable propellant is 11,000 pounds. An estimated weight breakdown for the design goal is provided for comparative purposes. This configuration is sized for 45,000 pounds usable propellant for the 25,000 pound LEM.

The original design goal weight of 8,595 for the burnout condition was based on lunar configuration sized for 31,000 pounds usable propellant.

~~CONFIDENTIAL~~WEIGHT HISTORYCOMMAND MODULE

ITEM	DESIGN GOAL	AUTHORIZED CHANGES	DESIGN GOAL ADJUSTED 7-1-64
Structure	3824	+277	4101
Stabilization & Control	181		181
Guidance & Navigation	261	+90	351
Crew System	530		530
Environmental Control	235	-11	224
Earth Landing System	610	+49	659
Instrumentation	173	+7	180
Electrical Power	390	+10	400
Reaction Control	195		195
Communication	330	+33	363
Controls & Displays	261	+19	280
WEIGHT EMPTY	6990	+474	7464
Scientific Equipment	250	-170	80
Crew	528		528
Suits & Personal Equipment	304	+58	362
Food & Containers	90		90
Reaction Control Propellant	210		210
Environmental Control Fluids	128		128
GROSS WEIGHT	8500	+362	8862

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COMMAND MODULE WEIGHT HISTORYWEIGHT EMPTY AUTHORIZED CHANGES

STRUCTURE

Change parachute attach to a two leg configuration for incorporation of the "Tumbling Concept" at earth impact attenuation. (CCA No. 93)

Delete the extendable heat shield window covers and replace current windows with high temperature glass consisting of (3) parallel glass panes. (CCA No. 105)

Add LEM docking provisions for LOR.

GUIDANCE & NAVIGATION

Increase the Guidance and Navigation per recent weight report from MIT. Since NAA does not have weight control responsibility for the MIT design, the weight changes in their Weight and Balance Report will be considered as authorized changes.

ENVIRONMENTAL CONTROL

Add a CO₂ sensor to the ECS as a part of the ECS operational instrumentation. (CCA No. 43)

Add a surge tank to ECS and delete entry oxygen supply to provide early mission emergency gas flows. (CCA No. 52)

Deletion of regenerative heat exchanger from the ECS heat exchanger package. (CCA No. 63)

Decrease pressure suit gas flow requirement for ventilation flow from 12 CFM to 10 CFM. (CCA No. 121)

EARTH LANDING SYSTEM

Add a dual drogue system installation to replace the single drogue system. (CCA No. 195)

COMMAND MODULE WEIGHT HISTORYWEIGHT EMPTY AUTHORIZED CHANGES

INSTRUMENTATION	(+7)	
Increase the PCM output bit rate from 31,000 to 51,200 bit/sec. This change was originally considered to have negligible weight affect but has henceforth been reported by Collins to cause a seven pound increase. (CCA No. 44)		+7
ELECTRICAL POWER	(+10)	
Add two batteries to provide a source of power, separate from the primary D.C. power, to initiate pyrotechnic devices. (CCA No. 28)		+10
Delete automatic LES tower ejection function from flight sequencer for normal missions. (CCA No. 91)		-1
Provide a PLSS battery charger connection to the Spacecraft battery charger that will allow charging of the 28 volt battery through the battery charging selector switch. (CCA No. 82)		+1
COMMUNICATIONS	(+33)	
Add a spacecraft up-data link for the purpose of providing current GOSS data within the spacecraft for display and comparison with the on-board computed data. (CCA No. 54)		+35
Change the present two speed data storage to a three speed machine to provide fast dump of data. (CCA No. 59)		-2
CONTROLS & DISPLAYS	(+19)	
Furnish and install a clock timer panel at the navigation station lower equipment bay. (CCA No. 84)		+2
Increase G & N navigation controls coded to controls and displays per MIT status.		+4
Add rendezvous radar for LOR.		+13
TOTAL COMMAND MODULE WEIGHT EMPTY CHANGES		+474

COMMAND MODULE WEIGHT HISTORYUSEFUL LOAD AUTHORIZED CHANGESSUITS & PERSONAL EQUIPMENT

(+58)

Change the following GFE (NASA) responsibility items:

Increase personal radiation dosimeters per NASA Crew Systems Meeting Number 19, Action Item Number 6.	+10
Increase PLSS per Hamilton Standard status.	+72
Delete initial charge water for coolant, from PLSS, as this item is now carried in the potable water tank.	-5
Delete one PLSS consistent with requirements for LOR mission.	-66
Delete primary oxygen from remaining PLSS.	-1
Increase Pressure Garment Assembly per Hamilton Standard engineering memo.	+49
Add a spacesuit mounted communication, electrical monitoring and telemetry per Hamilton Standard.	+2
Decrease constant wear garments per Hamilton Standard.	-3

SCIENTIFIC EQUIPMENT

(-170)

Delete the requirement to carry 170 pounds of scientific equipment in the lower equipment bay per NASA direction. (CCA No. 186)	-170
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TOTAL COMMAND MODULE USEFUL LOAD CHANGES

-112

~~CONFIDENTIAL~~WEIGHT HISTORYSERVICE MODULE

ITEM	DESIGN GOAL	AUTHORIZED CHANGES	DESIGN GOAL ADJUSTED 7-1-64
Structure	3203	+40	3243
Environmental Control	250		250
Instrumentation	100		100
Electrical Power	1203		1203
Propulsion System			
Engine Installation	606		606
Propellant System	2456		2456
Reaction Control	737		737
Communications & Rendezvous Radar	45	+120	165
WEIGHT EMPTY	8600	+160	8760
Usable RCS Propellant	611		611
Usable Fuel Cell Reactants	479		479
Environmental Control Fluids	193		193
Main Propulsion Helium	139		139
Main Prop. Residuals	900		900
Unusable RCS Propellant	61		61
Unusable Fuel Cell Reactants	17		17
BURNOUT WEIGHT	11000	+160	11160
Main Propellant	45000		45000
GROSS WEIGHT	56000		56160

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SERVICE MODULE WEIGHT HISTORYWEIGHT EMPTY AUTHORIZED CHANGES

STRUCTURE	(+40)
Add structural beef-up required to support the rendezvous radar equipment.	+40
COMMUNICATION & RENDEZVOUS RADAR	(+120)
Add rendezvous radar equipment consistent with the LOR requirements.	+120
	<hr/>
TOTAL SERVICE MODULE WEIGHT EMPTY CHANGES	+160

POTENTIAL WEIGHT CHANGESCOMMAND MODULEBLOCK I

<u>STRUCTURE</u>	(-179)
Increase inner structure honeycomb panels due to addition of epoxy for void repair.	+13
Increase heat shield equipment bay wire raceway based on redesign from small fiberglass to large aluminum raceway.	+12
Increase aft heat shield truss members to support side loads of the new electrical raceway.	+10
Decrease ablator due to reducing ablator thickness required by the addition of the full boost cover and thermal control paint. This change will be incorporated into the late Block I vehicles.	-265
Provide retention cables for outer hatch per NASA DEI.	+3
Increase aft heat shield due to adding provisions to insure that floodable compartments will flood rapidly at landing per NASA DEI.	+28
Increase secondary structure main display panel due to providing hand holds per NASA DEI.	+5
Provide recovery lifting loop at top of forward egress tunnel per NASA DEI.	+15
<u>STABILIZATION & CONTROL</u>	(+32)
Add floating devices and guide pins to lower equipment bay unit connectors to allow the electronic units to align prior to connector mating.	+2
Increase electronic equipment and connectors due to humidity fixes.	+30

POTENTIAL WEIGHT CHANGESCOMMAND MODULEBLOCK I

<u>GUIDANCE & NAVIGATION</u>	(+20)
Incorporate Block I-F G & N system.	+20
<u>CREW SYSTEMS</u>	(-43)
Decrease crew couch and restraint harnesses per changes resulting from Block I DEI's.	-43
<u>ENVIRONMENTAL CONTROL</u>	(+5)
Redesign waste management system due to changing to a new urine dump system.	+5
<u>ELECTRICAL POWER</u>	(+7)
Increase interior floodlights due to replacing flood lights with larger units employing standard filaments.	+3
Decrease inverters based on Westinghouse status.	-4
Increase dead end switch based on current requirement of four in lieu of two.	+8
<u>REACTION CONTROL</u>	(+19)
Add supports for RCS motor fuel and oxidizer lines required due to vibration per NASA DEI.	+19
<u>COMMUNICATION</u>	(+30)
Add floating devices and guide pins to lower equipment bay unit connectors to allow the electronic units to align prior to connector mating.	+2
Provide connection for swimmer communication hardline per NASA DEI.	+1
Replace dummy signal conditioner module with active module.	+7
Increase electronic equipment and connectors due to humidity fixes.	+20

POTENTIAL WEIGHT CHANGESCOMMAND MODULEBLOCK ICONTROLS & DISPLAYS

(+6)

Incorporate SPS chamber pressure readout.

+6

BALLAST

(+270)

Add ballast required to attain an L/D of .42.

+270

TOTAL COMMAND MODULE POTENTIAL WEIGHT CHANGES

+167

POTENTIAL WEIGHT CHANGESSERVICE MODULEBLOCK I

<u>STRUCTURE</u>	(+96)
Increase engine mount and backup structure due to stiffness requirement.	+50
Increase pads for vertical adjustment due to increased ablator thickness.	+18
Increase upper section of radial beam due to redesign due to the adjustable pin concept.	+8
Increase paint requirements per latest information from Materials and Producibility.	+15
Increase compression and shear pads on the radial beams due to revised calculations of latest drawing changes.	+5
<u>ELECTRICAL POWER</u>	(+31)
Increase fuel cell water condition sensor per Pratt and Whitney status.	+3
Decrease fuel cell per Pratt and Whitney status.	-9
Add dead end switches as it is necessary to dead end main booster circuits.	+2
Increase water glycol per new estimate of volume.	+16
Increase cryogenic tanks per Beech status.	+4
Increase cryogenic hydrogen tank outer shell due to elimination of chem-milling.	+15
<u>PROPULSION</u>	(+210)
Increase SPS propellant based on new mixture ratio tolerance and trapped residuals.	+210

POTENTIAL WEIGHT CHANGESSERVICE MODULEBLOCK IREACTION CONTROL

(+12)

Redesign RCS engine support housing to accommodate
increased dynamic loads.

+12

TOTAL SERVICE MODULE POTENTIAL WEIGHT CHANGES

+349

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BLOCK II
DETAIL WEIGHT STATEMENT
COMMAND MODULE

ITEM		ESTIMATED WEIGHT 7-1-64
<u>WEIGHT EMPTY</u>		8232
Structure	4468	
Stabilization & Control	207	
Guidance & Navigation	370	
Crew Systems	391	
Environmental Control	339	
Earth Landing System	694	
Instrumentation	249	
Electrical Power	579	
Reaction Control	336	
Communication	275	
Controls & Displays	324	
<u>USEFUL LOAD</u>		1438
Scientific Equipment	80	
Crew Systems	984	
Reaction Control	270	
Environmental Control	104	
GROSS WEIGHT		9670
Block II Weight Reduction Contingency	160	
Ballast for L/D = .43	220	
BLOCK II COMMAND MODULE		10050

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SID 62-99-29

BLOCK II
DETAIL WEIGHT STATEMENT
COMMAND MODULE
STRUCTURE

ITEM		ESTIMATED WEIGHT 7-1-64
<u>STRUCTURE</u>		
Inner Structure		(998)
Forward Section		154
Honeycomb Panels	48	
Frames, Rings and Hatches	57	
Fittings and Attachments	49	
Center Section		646
Honeycomb Panels	213	
Longerons, Frames and Rings	234	
Windows and Hatches	96	
Fittings and Attachments	103	
Aft Section		198
Honeycomb Panel	119	
Ring	79	
Secondary Structure		(600)
RH Equipment Bay and Coldplates		101
LH Equipment Bay		93
Fwd. LH Equipment Bay		23
Fwd. RH Equipment Bay and Coldplates		19
Main Display Panel and Coldplates		96
Lower Equipment Bay and Coldplates		162
Aft Equipment Bay		70
Crew Area		5
Heat Shield Equipment Area		31
Heat Shield Substructure		(1366)
Forward Section		142
Honeycomb Panels	84	
Frames and Rings	17	
Fittings and Mechanism	41	
Center Section		685
Honeycomb Panels	285	
Frames and Rings	90	
Doors and Covers	177	
Fittings, Mechanism and Attachments	117	
Air Vent	16	
Aft Section		539
Honeycomb Panels	360	
Frames and Rings	47	
Fittings and Attachments	84	
Toroidal Assembly	48	
Ablation Material		(1137)
Forward Section		118
Center Section		397
Aft Section		622
Insulation		(195)
Separation Provisions and Attachments		(22)
LEM Docking Provisions		(150)
 TOTAL STRUCTURE		 4468

BLOCK II
DETAIL WEIGHT STATEMENT
COMMAND MODULE
STABILIZATION AND CONTROL

ITEM	ESTIMATED WEIGHT 7-1-64
<u>STABILIZATION AND CONTROL</u>	
Lower Equipment Bay	(171.7)
Rate Gyro Package	5.2
Body Mounted Gyro Packages (2)	19.2
ECA Packages (7)	147.3
Electrical Provisions	(35.3)
Wiring, etc.	34.7
SCS Power Junction Box	.6
	<hr/>
TOTAL STABILIZATION AND CONTROL	207.0

BLOCK II
DETAIL WEIGHT STATEMENT
COMMAND MODULE
GUIDANCE & NAVIGATION

ITEM	ESTIMATED WEIGHT 7-1-64
<u>GUIDANCE AND NAVIGATION</u>	
Electronic Equipment	(234.0)
Inertial Measurement Unit	42.0
Navigation Base	18.0
Computer	92.5
Power Servo Assembly	45.1
Coupling Display Unit	22.9
Bellows Assembly	13.5
Optical Equipment	(53.6)
Sextant	18.7
Telescope	14.3
Optical Base	17.0
Optical Eyepieces	3.6
Loose Stored Items	(3.4)
Film Cartridges (4)	1.9
Eye Relief Eyepieces	1.5
Electrical Provisions	(78.3)
Cabling MIT	38.0
Cabling NAA	23.3
Rendezvous Radar Wiring	17.0
Coolant Hoses	(.7)
 TOTAL GUIDANCE AND NAVIGATION	 <hr/> 370.0

BLOCK II
DETAIL WEIGHT STATEMENT
COMMAND MODULE
CREW SYSTEMS

ITEM	ESTIMATED WEIGHT 7-1-64
<u>CREW SYSTEMS</u>	
Crew Accessories	(13.0)
Egress Accessories - Hatch	13.0
Crew Couch Structure & Attenuation	(310.7)
Center Couch (1)	56.7
Outboard Couches (2)	157.0
Attenuation	97.0
Crew Couch Pads & Restraints	(30.0)
Pad Assy - Couch	10.0
Harness Assy. - Restraint	12.0
Restraint Assy - Rest Station	4.0
Restraint Lower Equip. Bay	2.0
Sandals - Weightless Restraint	2.0
Window Filter Assemblies	(3.8)
Food Associated Equipment	(6.6)
Food Storage Boxes	5.6
Water Metering	1.0
Waste Management System (See ECS for System Wt.)	(2.7)
Canister Assy - Fecal	1.4
Receptacle Assy - Relief Crewman	1.3
Crew Equipment	(24.2)
Umbilical Assy - Crewman	17.9
Hose Assy. - PLSS O ₂ Recharge	2.8
Electrical Umbilical - PGA	2.5
Constant Wear Garment Stowage	1.0
TOTAL CREW SYSTEMS	391.0

BLOCK II

DETAIL WEIGHT STATEMENT

COMMAND MODULE

ENVIRONMENTAL CONTROL SYSTEM

ESTIMATED
WEIGHT
7-1-64

ITEM

ENVIRONMENTAL CONTROL SYSTEM

Pressure Suit Circuit	(108.3)
Subcontractor Compressor, Heat Exchg., Val. & Cont.	70.8
Ducting, Conn., Clamps, & Compr. Sel. Sw.	15.5
CO ₂ Sensor	2.0
LiOH By-Pass	10.0
Free Condensate Control	10.0
Water-Glycol Circuit	(82.9)
Subcontractor Res., Evaporator, Pump, Val. & Contr.	35.4
Water-Glycol	24.4
Plumbing & Glycol Pump Sel. Sw.	12.6
Pump & Loop for S/M TCS	10.5
Pressure & Temp. Control	(19.1)
Subcontractor Heat Exchg., Blower, Val. & Cont.	16.7
Ducting & Cabin Blower Sel. Sw.	2.4
Oxygen Supply System	(17.2)
Subcontractor Val. & Cont.	5.2
Plumbing	4.5
Oxygen Surge Tank	7.5
Water Supply System	(32.5)
Subcontractor Potable & Waste Tanks	24.2
Plumbing	3.3
LEM Water Transfer System	5.0
Subcontractor Common Items	(27.5)
Brackets, Plumbing, Elect. Wiring	13.0
Instrumentation	14.5
Waste Management System	(22.4)
Supports	(11.0)
Propellant Temperature Control System	(4.0)
Electrical Provisions	(7.8)
Manual Controls - Push Pull	(3.6)
N ₂ Purge System	(2.7)

TOTAL ENVIRONMENTAL CONTROL SYSTEM

339.0

BLOCK II
DETAIL WEIGHT STATEMENT
COMMAND MODULE
EARTH LANDING SYSTEM

ITEM	ESTIMATED WEIGHT 7-1-64
<u>EARTH LANDING SYSTEM</u>	
Parachute System	(576.5)
Drogue Chute System	68.2
Main Cluster	425.6
Pilot Chute System	25.7
Sequencer Control	8.7
Attach Provisions	48.3
Location Aids	(5.3)
Forward Heat Shield Release System	(42.5)
Drogue Disconnect Installation	(9.6)
Electrical Pyrotechnic Initiation Provisions	(5.0)
Crushable Honeycomb - Impact Attenuation	(40.1)
Flotation Bag System	(15.0)
	<hr/>
TOTAL EARTH LANDING SYSTEM	694.0

BLOCK II
DETAIL WEIGHT STATEMENT
COMMAND MODULE
INSTRUMENTATION

<u>ITEM</u>	<u>ESTIMATED</u> <u>WEIGHT</u> 7-1-64
<u>INSTRUMENTATION</u>	
Lower Equipment Bay	(25.0)
PCM	25.0
Remote Equipment	(41.0)
Sensors	35.0
TV Camera	4.5
TV Viewfinder	1.5
Electrical Provisions	(183.0)
Inflight Test Electrical Provisions	5.0
Data Distribution Panel	2.3
Instrumentation Electrical Provisions	124.0
S-IV B EDS	20.0
LEM Checked (Docked)	25.0
LEM EDS (Stowed)	6.0
Radiation Detection Provisions	.7
	<hr/>
TOTAL INSTRUMENTATION	249.0

BLOCK II

DETAIL WEIGHT STATEMENT

COMMAND MODULE

ELECTRICAL POWER

ITEM	ESTIMATED WEIGHT 7-1-64
<u>ELECTRICAL POWER</u>	
Energy Source	(55.8)
Battery - Re-Entry (2)	36.2
Battery - Post Landing (1)	18.1
Battery Vent System	1.5
Power Conversion	(125.0)
Inverter (3) & Control	117.0
Battery Charger & Controls	4.0
DC-DC Converter	4.0
Power Distribution & Control	(118.2)
D-C Power Panel Assy	7.6
A-C Power Box Assy	10.5
Battery Circuit Breaker Panel	3.4
Lower Equipment Bay Panel	4.2
Terminal Distribution Panel (Bus)	9.6
Circuit Breaker Panel	4.7
Electrical Transmission (Wiring, Connectors, Cond., Sup.)	53.7
Ground Power Provisions	4.5
Power Control Panel Connectors	3.0
Installation Provisions	10.0
Phase Correcting Capacitor	6.0
Inverter Bus Selection Control	1.0
Electrical Common Utility	(280.0)
Electrical Transmission (Wiring, Conn., Cond., & Sup.)	106.6
Right Hand Circuit Breaker Panel	17.1
Left Hand Circuit Breaker Panel	10.9
Lighting Equipment	6.5
Lighting	2.5
Adapter Separation System	2.5
LES Separation System	15.1
Circuit Utilization Package	6.3
Sequencer	39.1
Installation Provisions	13.3
C/M to S/M Separation System Wiring & Hardware	7.2
SPS Electrical Provisions - S/M	17.3
RCS Electrical Provisions - S/M	11.1
Booster S/C Separation Sequencer	5.0
Fuse Box Assy.	6.0
Cryogenic Sys. Wiring	5.5
Humidity Fix	10.0
TOTAL ELECTRICAL POWER	579.0

BLOCK II
DETAIL WEIGHT STATEMENT
COMMAND MODULE
REACTION CONTROL SYSTEM

ITEM	ESTIMATED WEIGHT 7-1-64
<u>REACTION CONTROL SYSTEM</u>	
Propellant System	(72.7)
Oxidizer System	36.9
Tanks & Expulsion Devices	14.7
Plumbing, Fittings & Insulation	11.4
Valves & Regulators	10.3
Sensors	.5
Fuel System	35.8
Tanks & Expulsion Devices	13.6
Plumbing, Fittings & Insulation	11.4
Valves & Regulators	10.3
Sensors	.5
Pressure System	(56.4)
Tanks (4500 psi)	10.5
Plumbing, Fittings & Insulation	4.8
Valves & Regulators	38.6
Sensors	2.5
Engine System	(141.2)
Engines	99.2
Nozzle Extension	42.0
Electrical Provisions	(33.7)
Switching Panel	21.4
Wiring	12.3
Dumping System	(32.0)
Valves & Supports	13.0
Controls & Electrical Provisions	12.0
Plumbing & Fittings	5.0
Miscellaneous	2.0
 TOTAL REACTION CONTROL SYSTEM	 336.0

BLOCK II
DETAIL WEIGHT STATEMENT
COMMAND MODULE
COMMUNICATIONS

ITEM	ESTIMATED WEIGHT 7-1-64
 <u>COMMUNICATIONS</u>	
Lower Bay	(179.9)
Unified S-Band	29.0
S-Band Power Amplifier	30.0
HF Transceiver	7.0
VHF AM Trans. - Rec	10.2
Signal Conditioner	43.0
Recorder	25.1
Audio Center	6.5
Premodulation Processor	11.0
Central Timing Equipment	6.5
Up Data Link	10.0
VHF Rec. Bea.	1.6
 Remote Equipment	 (54.2)
VHF-HF Recovery Antenna & Transmission	13.0
2-KMC High Gain Antenna Transmission Lines	4.4
2-KMC Omni Ant., Trans. & Instl. Prov.	32.3
VHF Trans. Lines	4.5
 Electrical Provisions	 (40.4)
Electrical Wiring	21.6
Data Distribution Panel	1.5
Coax	5.2
Connectors - Coax	6.1
Wiring High Gain Ant.	6.0
Supports	(.5)
 TOTAL COMMUNICATIONS	 <hr/> 275.0

NOTE: Early Block II flights will contain C-band +35.5 pounds.

BLOCK II
DETAIL WEIGHT STATEMENT
COMMAND MODULE
CONTROLS AND DISPLAYS

ITEM	ESTIMATED WEIGHT 7-1-64
MAIN DISPLAY PANEL	
Main Display Panel Control Station	(80.6)
SCS Mode Select	4.5
Delta Velocity	4.3
Flight Director Attitude Indicator	12.9
Attitude Set and Gimbal Position Displays	10.0
SPS Gimbal Actuator	.5
Entry Monitoring Indicator	23.0
Launch Vehicle Emergency Detection System	6.2
Master Caution and Abort Lt.	.3
Barometric Indicator	1.8
Event Timer	1.5
Mounting Panels	2.4
Rendezvous Radar Panel	7.0
LEM D & C	1.0
Docking Provisions	2.2
S-IV B Prop. Mgmt. & Contr.	3.0
Main Display Panel Center Station	(53.9)
Audio Panel	1.2
Abort Light	.2
Reaction Control	10.5
GMT Readout	.8
ECS Gages and Controls	5.3
Crew Safety Controls	1.6
High Gain Antenna Control	5.0
Cryogenic	5.9
Caution and Warning Display	9.8
Mounting Panels	10.1
Radiation Display	3.5
Main Display Panel System Management Station	(30.5)
Communications Control Panel	5.7
Master Caution Lights	.2
Power Distribution	6.1
Fuel Cells Controls	3.2
Service Propulsion	7.4
Oxygen Warning	.1
Mounting Panels	7.8
Main Display Panel RH Console	(10.5)
Bus Switches	5.7
Audio Panel	1.2
Lighting Control	1.6
Mounting Panels	2.0
Main Display Panel LH Console	(7.9)
Mission Sequence Controls	1.0
Lighting Control	1.6
Audio Panel	1.2
SCS Power Control	2.2
Mounting Panels	1.9
 TOTAL MAIN DISPLAY PANEL	 <hr/> 183.4

BLOCK II
DETAIL WEIGHT STATEMENT
COMMAND MODULE
CONTROLS AND DISPLAYS

ITEM	ESTIMATED WEIGHT 7-1-64
 REMOTE EQUIPMENT	
Lower Equipment Bay	(51.0)
Lighting Control Panel	1.2
G & N Controls and Displays	49.8
Map and Data Viewer	9.6
Display and Control - Navigation	19.8
Display and Control - Computer	20.4
 Left Hand Forward Equipment Bay	 (3.1)
Clock	.8
Event Timer	2.0
Mounting Panel	.3
 Crew Area Controls	 (17.7)
Manual Control - Rotation	10.0
Manual Control - Translational	7.7
 Caution and Warning	 (14.0)
Detector	14.0
 Electrical Provisions	 (54.8)
Electrical Wiring	54.1
SCS/G & N Display Junction Box	.7
 TOTAL REMOTE EQUIPMENT	 <hr/> 140.6
 TOTAL MAIN DISPLAY PANEL	 183.4
 TOTAL CONTROLS AND DISPLAYS	 <hr/> 324.0

BLOCK II
DETAIL WEIGHT STATEMENT

COMMAND MODULE

USEFUL LOAD

ITEM		ESTIMATED WEIGHT 7-1-64
<u>CREW SYSTEMS</u>		
Government Furnished Equipment		(929.7)
Crew (50, 70, 90)		528.0
Spacesuit Assy. (SSA)		251.6
Pressure Garment Assy (PGA)		129.2
Torso Assy.	73.9	
Helmet Assy	25.3	
Thermal Assy	22.8	
Constant Wear Garment	2.6	
Urine and Feces Assy.	4.6	
Portable Life Support System (PLSS) (2)		110.4
Back Pack	(100.0)	
System Equip.	81.2	
LiOH Cartridge (Charged)	7.0	
Water (Initial Charge)	10.0	
Oxygen (Initial Charge)	1.8	
Emergency O2 System (Charged)	(10.4)	
Communications, Electrical Monitoring & Telemetry (CEMT)		12.0
Suit Mounted (3)	2.4	
Back Pack Mounted (1)	9.6	
Constant Wear Garments (6)		5.3
Instrument Assy. - Biomedical Sensors & Preamplifier		2.0
Dosimeter - Radiation, Personal		11.8
Whole Body Tissue Dosimeter	9.0	
Extremity Dosimeter	1.1	
Charger Reader	1.7	
Food & Food Packaging		58.3
Food (Based on NAA Type)	48.0	
Package Set	8.8	
Drinking Water Probe	1.5	

BLOCK II

DETAIL WEIGHT STATEMENT

COMMAND MODULE

USEFUL LOAD

ESTIMATED
WEIGHT
7-1-64

CREW SYSTEMS (CONT.)

Government Furnished Equipment (Cont.)

Medical Equipment 5.5

Medical Kit - Dressing, Emerg.	.4
Medical Kit - Medication, Emerg.	3.7
Instrument Set - Physiological Monitoring	1.4

Survival Kit (Contents) (3) 67.2

One Man Life Raft	18.0
Sea Dye Marker (24 Hr)	6.4
Water Container	1.2
Water	18.0
Desalting Kit	2.9
Signal Mirror	1.2
Transceiver	14.0
Sunglasses	.2
First Aid Kit	.6
Flare Set	.8

(The above items are per NAA/NASA Definition)

Knife - Survival	1.1
Life Vests	0.8
Balloon Kits	0.6
Light Assy - Survival	0.4
Light Assy - Location C/M	1.0

(The above items are per NAA Definition)

ACR Strobe Light	-
Compass	-
Sparky Lighter	-
Nylon Cord	-
Sewing Kit	-
Fishing Kit	-
Whistle	-
Machete	-

(The above items listed by NASA in Ltr.
3056 MA (5 March 1964) are not being
carried weightwise until definite requirement
is established)

BLOCK II

DETAIL WEIGHT STATEMENT

COMMAND MODULE

USEFUL LOAD

ITEM		ESTIMATED WEIGHT 7-1-64
<u>CREW SYSTEMS (CONT.)</u>		
NAA - S&ID Furnished Equipment		(54.3)
Survival Kit Containers (3)		10.5
Crew Accessories		18.5
Flight Kit Assy (2)	6.0	
Tool Set - Inflight Maint.	3.5	
Light Assy - Portable	3.0	
Crew Optics	6.0	
Crewman Equipment		1.0
Belt Assy - Inflight Tool Set	1.0	
Food Associated Equipment		2.0
Mouthpiece - Food Personal	2.0	
Personal Communications (3)		5.1
Bump Helmet	3.9	
Electronics	1.2	
Personal Hygiene Equipment		10.7
Cleansing Pad Set	6.0	
Dentifrice Set - Ingestible	0.1	
Shaver Assy (1)	0.8	
Towel Assy - Utility	0.8	
Storage Container - Personal Hygiene	3.0	
Medical Kit Container		4.0
Waste Management		1.5
Bag Set - Fecal/Emesis	1.5	
Supports		1.0
TOTAL CREW SYSTEM		984.0

BLOCK II
DETAIL WEIGHT STATEMENT

COMMAND MODULE

USEFUL LOAD

ITEM	ESTIMATED WEIGHT 7-1-64
<u>REACTION CONTROL</u>	(270.0)
Usable Propellant	225.0
Residual Propellant	44.0
Trapped - System	30.8
Mixture Ratio	2.7
Expulsion Efficiency	7.8
Loading Tolerance	2.7
RCS Helium	1.0
<u>ENVIRONMENTAL CONTROL</u>	(104.0)
Lithium Hydroxide	72.0
Activated Charcoal	2.6
Containers for LiOH & Charcoal	8.2
Oxygen - Re-Entry	3.7
Water-Earth Orbit Cooling & Drinking	3.5
Water-Boost Cooling	4.0
Water-Emergency Re-Entry Cooling	6.0
Chemical Disinfectant	4.0
<u>SCIENTIFIC EQUIPMENT</u>	(80.0)
TOTAL This Page	454.0
TOTAL CREW SYSTEM	984.0
TOTAL USEFUL LOAD	1438.0

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BLOCK II
DETAIL WEIGHT STATEMENT
SERVICE MODULE
SUMMARY

ITEM		ESTIMATED WEIGHT 7-1-64
<u>WEIGHT EMPTY</u>		7565
Structure	2310	
Environmental Control	205	
Instrumentation	141	
Electrical Power	1432	
Propulsion	2730	
Reaction Control	527	
Communication & Rendezvous Radar	220	
<u>USEFUL LOAD</u>		2415
Reaction Control	838	
Electrical Power	503	
Environmental Control	208	
Propulsion	866	
<u>BURNOUT WEIGHT</u>		9980
Block II Weight Reduction Contingency	150	
BLOCK II SERVICE MODULE		10130

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BLOCK II
DETAIL WEIGHT STATEMENT
SERVICE MODULE
STRUCTURE

ITEM	ESTIMATED WEIGHT 7-1-64
<u>STRUCTURE</u>	
Basic Body Structure	(1382)
Honeycomb Panels	457
Frames and Rings	4
Access Doors	13
Fittings and Attach Parts	53
Radial Beams	336
Internal Partitions	37
Forward Bulkhead	68
Aft Bulkhead	300
RCS Panels	114
Secondary Structure	(235)
Tank Support Shelf	29
Engine Support Structure	104
Antenna Support Structure	50
Aft Heat Shield	52
Insulation	(277)
Separation Provisions and Attachments	(16)
Fairing - C/M to S/M	(161)
Miscellaneous	(39)
Meteoroid Protection	(100)
Passive Temperature Control	(100)
 TOTAL STRUCTURE	 <hr/> 2310

BLOCK II
DETAIL WEIGHT STATEMENT
SERVICE MODULE
ENVIRONMENTAL CONTROL SYSTEM

ITEM	ESTIMATED WEIGHT 7-1-64
<u>ENVIRONMENTAL CONTROL SYSTEM</u>	
Freon Circuit	(190.0)
Subcontractor Valves & Controls	80.5
Plumbing and Supports	20.5
Freon	10.0
Space Radiator (Outer Skin)	74.0
Wiring	5.0
Water Supply System	(6.6)
Plumbing and Hardware	6.6
Oxygen Supply System	(3.0)
Plumbing and Supports	3.0
Common Items	(5.4)
Supports (S&ID)	3.5
Wiring	1.9
TOTAL ENVIRONMENTAL CONTROL SYSTEM	<hr/> 205.0

BLOCK II
DETAIL WEIGHT STATEMENT
SERVICE MODULE
INSTRUMENTATION

ITEM	ESTIMATED WEIGHT 7-1-64
<u>INSTRUMENTATION</u>	
Instrumentation	(29.0)
Electrical Provisions	(82.0)
Supports	(5.0)
Radiation Detection	(3.0)
LEM Monitoring in Stowed Position	(22.0)
	<hr/>
TOTAL INSTRUMENTATION	141.0

BLOCK II

DETAIL WEIGHT STATEMENT

SERVICE MODULE

ELECTRICAL POWER

ITEM	ESTIMATED WEIGHT 7-1-64
<u>ELECTRICAL POWER</u>	
Fuel Cell Power System	(1223.3)
Fuel Cell Power Pack (Incl. Mount Instrumentation)	738.9
Intermodular - Radiator Plumbing	47.5
Fuel Cell Module Mount Attach	1.1
Fuel Cell H ₂ System	
Subcontractor Components	151.6
Plumbing and Valves	5.7
Fuel Cell and ECS O ₂ System	
Subcontractor Components	176.8
Plumbing and Valves and Supports	32.3
Water Glycol - Fuel Cell Heat Transfer System	7.0
Elect. Wiring - Supercritical Gas	7.7
Space Radiator (Outer Skin)	40.5
Fuel Cell Module Stabilization Webs	2.9
Fuel Cell Plumbing Supports	6.0
Valve Module Control Box (Cryogenic Gas)	5.3
Power Distribution	(80.9)
Electrical Transmission	50.1
Power Distribution Box	30.8
Electrical Common Utility	(127.8)
Electrical Transmission	47.6
Sequencer	28.0
Adapter Separation System	1.4
C/M to S/M Separation System	2.5
Pyrotechnic Initiation	12.0
Provisions	9.9
LES Separation System Wiring & Hardware	6.4
Shape Charge Assy.	20.0
 TOTAL ELECTRICAL POWER	 1432.0

BLOCK II

DETAIL WEIGHT STATEMENT

SERVICE MODULE

MAIN PROPULSION

ESTIMATED
WEIGHT
7-1-64

ITEM

MAIN PROPULSION

Propellant System		(1261.0)
Oxidizer System		703.3
Tanks & Doors	483.0	
Skirts	59.8	
Plumbing, Fittings & Insulation	53.0	
Valves	4.5	
Quantity Indication	25.5	
Mixture Ratio Control	14.0	
Supports - Plumbing & Equipment	41.5	
Retention Reservoir	22.0	
Fuel System		557.7
Tanks & Doors	401.0	
Skirts	33.2	
Plumbing, Fittings & Insulation	42.0	
Valves	4.5	
Quantity Indication	25.5	
Supports - Plumbing & Equipment	30.5	
Retention Reservoir	21.0	
Pressure System		(730.0)
Tanks		584.0
Tank Supports		30.0
Plumbing, Fittings & Insulation		24.0
Valves, Regulators & Heat Exchanger		54.0
Supports - Plumbing & Equipment		38.0
Engine System		(710.0)
Engine		685.0
Closeouts - Throats to S/M		25.0
Electrical Wiring		(29.0)
TOTAL MAIN PROPULSION SYSTEM		2730.0

BLOCK II

DETAIL WEIGHT STATEMENT

SERVICE MODULE

REACTION CONTROL

ITEM	ESTIMATED WEIGHT 7-1-74
<u>REACTION CONTROL SYSTEM</u>	
Propellant System	(180.4)
Oxidizer System	92.1
Tanks & Expulsion Devices	33.4
Plumbing, Fittings & Insulation	8.5
Valves & Regulators	12.0
Sensors	3.0
Supports	18.2
Quantity Gaging	17.0
Fuel System	88.3
Tanks & Expulsion Devices	30.6
Plumbing, Fittings & Insulation	8.5
Valves & Regulators	12.0
Sensors	3.0
Supports	18.2
Quantity Gaging	16.0
Pressure System	(130.0)
Tanks (4500 psi)	21.0
Plumbing, Fittings & Insulation	6.0
Valves & Regulators	76.0
Sensors	7.0
Supports	20.0
Engine System	(117.2)
Engines	75.2
Supports & Insulation	42.0
Structural Provisions	(72.0)
Electrical Provisions	(27.4)
TOTAL REACTION CONTROL SYSTEM	<hr/> 527.0

BLOCK II
DETAIL WEIGHT STATEMENT
SERVICE MODULE
COMMUNICATIONS & RENDEZVOUS RADAR

ITEM		ESTIMATED WEIGHT 7-1-64
<u>COMMUNICATIONS</u>		(95.0)
Remote Equipment		70.0
High Gain Antenna	12.2	
Locking Provisions - High Gain Antenna	3.0	
Boom - High Gain Antenna	8.0	
Gimbal - High Gain Antenna	12.0	
Earth Sensor - High Gain Antenna	4.8	
VHF Antenna and Trans.	30.0	
Electrical Provisions		24.0
Wiring - Common Utility	14.0	
Coax & Connectors - High Gain Antenna	10.0	
Supports		1.0
<u>RENDEZVOUS RADAR</u>		(125.0)
Rendezvous Equipment		67.8
Radar Package (GAEC)	30.0	
X-Band Dish Ant. (GAEC)	20.0	
Antenna Boom (GAEC)	8.0	
Antenna Actuation Mechanism (GAEC)	6.0	
X-Band Tras. Lines & Suppt.	3.8	
Transponder Equipment		36.6
Transponder (GAEC)	18.0	
X-Band Flush Mntd. Omni Ant. (3)	3.0	
X-Band Trans. & Supports	12.6	
Duplexer & RF Switch	3.0	
Supports & Cooling Provisions		14.6
Rendezvous Equipment	9.6	
Transponder Equipment	5.0	
Electrical Provisions		6.0
Rendezvous Equipment	3.0	
Transponder Equipment	3.0	
 TOTAL COMMUNICATION & RENDEZVOUS RADAR		220.0

BLOCK II

DETAIL WEIGHT STATEMENT

SERVICE MODULE

USEFUL LOAD

ITEM		ESTIMATED WEIGHT 7-1-64
REACTION CONTROL		(838.0)
RCS Propellant		835.0
Usable	790.0	
Residual	45.0	
Trapped System	4.0	
Mixture Ratio	9.0	
Expulsion Efficiency	24.0	
Loading Tolerance	8.0	
RCS Helium		3.0
ELECTRICAL POWER (Normal Mission)		(503.0)
Hydrogen - Supercritical Gas		58.5
Usable (Electrochemical Incl. Tolerance)	46.0	
Unusable (Residual & Instrument Error)	3.2	
Emergency Provisions	4.7	
Expended (Leakage & Purge)	4.6	
Oxygen - Supercritical Gas		444.5
Usable (Electrochemical Incl. Tolerance)	377.0	
Unusable (Residual & Instrument Error)	17.5	
Emergency Provisions	44.0	
Expended (Leakage & Purge)	6.0	
ENVIRONMENTAL CONTROL (Normal Mission)		(208.0)
Oxygen - Supercritical Gas		208.0
Usable (metabolic)	76.5	
Unusable (Residual & Instrument Error)	9.1	
Emergency Provisions	25.3	
Expended (Leakage, LEM, PLSS, Repress.)	97.1	
PROPULSION		(866.0)
Main Propulsion Helium		77.0
Main Propellant Residuals		789.0
Trapped - System	239.0	
Trapped - Engine	67.0	
Mixture Ratio Tolerance	293.0	
Loading Tolerance	190.0	
TOTAL USEFUL LOAD (Less Main Propellant)		2415.0

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BLOCK II
DETAIL WEIGHT STATEMENT
LAUNCH ESCAPE SYSTEM

ITEM	ESTIMATED WEIGHT 7-1-64
<u>STRUCTURE</u>	(1239)
Tower Assy	301
Escape Motor Skirt	208
Canard & Structure	560
Nose Cone	35
Attaching Parts	14
Tower Insulation	111
Skirt Insulation	10
<u>SEPARATION PROVISIONS</u>	(13)
<u>BALLAST</u>	(729)
<u>PROPULSION</u>	(5349)
Escape Motor	4774
Jettison Motor	434
Jettison Motor Skirt	92
Pitch Control Motor	49
<u>ELECTRICAL POWER</u>	(85)
<u>C/M BOOST PROTECTION COVER (SOFT)</u>	(520)
 TOTAL LAUNCH ESCAPE SYSTEM	<hr/> (7935)

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BLOCK II
DETAIL WEIGHT STATEMENT

ADAPTER

SUMMARY

ITEM	ESTIMATED WEIGHT 7-1-64
<u>ADAPTER</u>	
Structure	(3505)
Basic Body Structure	
Honeycomb Panels	2512
Longerons	46
Frames & Rings	306
Access Doors	50
Fittings & Attachings Parts	76
Secondary Structure	
LEM Supports	55
Insulation	20
Separation Provisions & Attach	360
Paint	80
Propellant Dispersal System	(100)
Electrical Provisions	(70)
TOTAL ADAPTER	<hr/> 3675

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